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CHARACTERISTICS, RADIOLOGICAL FINDINGS, HEMATOLOGICAL LABORATORY RESULTS, AND MANAGEMENT APPROACHES OF TUBERCULOUS SPONDYLITIS AT PROF. DR. I.G.N.G. NGOERAH GENERAL HOSPITAL

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ABSTRACT

Background: Tuberculous spondylitis is an extrapulmonary tuberculosis of the spine that can cause deformity, spinal instability, and neurological deficits. Data on patient profiles at Prof. Dr. I.G.N.G. Ngoerah General Hospital are limited. This study aimed to describe demographic, radiological, hematological, and treatment characteristics of patients with tuberculous spondylitis.
Methods: A descriptive cross-sectional study was conducted using medical record data of patients treated from 2022 to 2024 with total sampling. Variables analyzed included demographic characteristics, radiological findings, hematological laboratory results, treatment approach, and histopathological findings. Data were presented descriptively as frequencies and percentages.
Results: Fifty-three patients were included with a mean age of 36.79±16.08 years, most were 21-40 years old. Males accounted for 52.8%. Active pulmonary TB was found in 24.5%. Neurological status was mainly AIS E (62.3%) followed by AIS D (28.3%). All patients had radiological features consistent with tuberculous spondylitis, most commonly in the lumbar (39.6%) and thoracic (33.9%) regions. Paradiscal lesions were predominant (81.1%), with gibbus deformity in 50.9% and skip lesions in 3.8%. Leukocyte counts were normal in 66%, while ESR and CRP were elevated in 96.2% and 73.6%, respectively. Operative management was performed in 64.2% of cases and typical tuberculous histopathology was confirmed in 47.1% of biopsied patients.
Conclusions: Patients with tuberculous spondylitis at Prof. Dr. I.G.N.G. Ngoerah General Hospital during 2022-2024 were predominantly of productive age, with paradiscal lesions mainly in the lumbar-thoracic regions, elevated ESR and CRP as the most common inflammatory markers, and operative treatment in most cases.
Keywords : Laboratory evaluation, Radiological evaluation, Management, Tuberculous spondylitis, Tuberculosis.

INTRODUCTION

Tuberculous spondylitis (Pott's disease) is a form of extrapulmonary tuberculosis affecting the spine and represents one of the most common and most severe manifestations of musculoskeletal tuberculosis.[1] Vertebral involvement can lead to vertebral destruction, kyphotic deformity, spinal instability, and even spinal cord compression. These complications increase the risk of neurological deficits, including parafplegia, particularly when diagnosis and treatment are delayed.[2] Therefore, tuberculous spondylitis is regarded as an important clinical problem due to its significant impact on patient function, quality of life, and disability.

The global burden of tuberculosis remains high and directly contributes to the incidence of extrapulmonary tuberculosis, including tuberculous spondylitis. The World Health Organization estimated that approximately 10.6 million tuberculosis cases occurred in 2022, with Indonesia being the second-largest contributor, accounting for around 10% of total cases worldwide.[3] Consistent with the high tuberculosis burden, tuberculous spondylitis remains a clinically relevant problem in Indonesia. At the regional level, tuberculosis continues to represent a major public health concern in Bali, where most patients are managed

using standardized anti-tuberculosis regimens in primary healthcare settings.[4] Although mortality from tuberculous spondylitis is relatively low, neurological complications, progressive deformity, and the need for long-term care can increase the burden on health services and raise the risk of permanent disability.

Early diagnosis of tuberculous spondylitis remains challenging due to nonspecific initial clinical manifestations, such as chronic back pain or mild constitutional symptoms.[5] Such delays are associated with poorer prognosis, including progressive deformity and neurological deficits.[6] Moreover, studies have shown that clinical, radiological, and hematological laboratory results may vary across populations due to differences in demographic characteristics, comorbidities, and immune responses, highlighting the need for local data to achieve accurate disease profiling.[7]

As a national referral hospital, Prof. Dr. I.G.N.G. Ngoerah General Hospital has managed a large number of tuberculosis cases, including tuberculous spondylitis. However, to date, no comprehensive report is available describing the characteristics, radiological findings, hematological laboratory results, and management patterns of patients with tuberculous spondylitis at this hospital. The availability of such data is important for identifying high-risk groups, strengthening early diagnostic strategies, and optimizing management according to the characteristics of the local population. Therefore, this study aims to describe the profile of patients with tuberculous spondylitis at Prof. Dr. I.G.N.G. Ngoerah General Hospital during the period 2022-2024, including demographic characteristics, radiological findings, hematological and laboratory results, treatment approach, and histopathological findings.

METHODS

Study Design

This study was a descriptive study with a cross-sectional design. All variables were measured at a single point in time based on data available in medical records. The study was conducted over eleven months, from December 2024 to November 2025, at Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar. The study period included the development of the research framework and instruments, administrative approval, data collection, data processing and analysis, and preparation of the final report.

Study Population and Sample

The target population comprised all patients with tuberculous spondylitis, while the accessible population included all patients diagnosed with tuberculous spondylitis who were recorded and received medical care at Prof. Dr. I.G.N.G. Ngoerah General Hospital between January 1, 2022 and December 31, 2024. Sampling was performed using a total sampling method for subjects who met the inclusion criteria, which were (1) patients diagnosed with tuberculous spondylitis and (2) availability of complete medical records covering the study variables, including demographic data, radiological findings, hematological laboratory results, and management during the study period. The exclusion criteria were (1) incomplete medical records and (2) medical record numbers listed in the registry that could not be found in the hospital's medical record system or files. The minimum required sample size was calculated using the proportion formula for descriptive studies $n = Z_\alpha^2\, p(1-p)/d^2$. With $Z_\alpha = 1.96$, an estimated proportion $p = 0.02$ (based on the prevalence of tuberculous spondylitis reported in Spinal Tuberculosis, 2018), and a precision $d = 0.05$, the minimum sample size obtained was 30.1, rounded up to at least 31 subjects.[8]

Data Collection Procedures

Data were collected retrospectively from medical records. The collected data included demographic characteristics, radiological findings, hematological laboratory results, and patient management. Data were initially recorded using Google Forms as a structured data entry tool. The collected data were then transferred to a data extraction sheet for further analysis.

Data Analysis

Data were analyzed descriptively using SPSS version 26. Normality testing was performed using the Shapiro–Wilk test to determine the appropriate presentation of numerical data. A p-value > 0.05 indicated a normal data distribution, and such data were presented as mean and standard deviation (SD). Categorical data were presented as frequencies (n) and percentages (%). The results of the analysis were presented in tables and narrative form to describe the patient profile with tuberculous spondylitis.

RESULTS

Characteristics of the study sample

This study included 53 patients with tuberculous spondylitis who were registered in the Medical Records Unit of Prof. Dr. I.G.N.G. General Hospital during 2022-2024. The distribution of baseline characteristics is presented in Table 1. The age distribution covered all age groups, with the largest proportions in the 21-30 year and 31-40 year groups, each comprising 12 patients (22.6%). The 41-50 year group included 10 patients (18.9%), while the 51-60 year group comprised 7 patients (13.2%). The 0-10 year, 11-20 year, and >60 year groups each consisted of 4 patients (7.5%). The patients ages ranged from 3 to 74 years, with a mean age of 36.79 ± 16.08 years.

Sex distribution was relatively balanced, with 28 male patients (52.8%) and 25 female patients (47.2%). Regarding comorbid conditions, 40 patients (75.5%) had no evidence of active pulmonary involvement, whereas pulmonary tuberculosis was identified in 13 patients (24.5%). Neurological status

according to the ASIA Impairment Scale was predominantly AIS E in 33 patients (62.3%), followed by AIS D in 15 patients (28.3%). AIS C was observed in 2 patients (3.8%) and AIS B in 3 patients (5.7%), while no patients had a complete neurological deficit (AIS A).

Table 1. Characteristics of Patients with Tuberculous Spondylitis at Prof. Dr. I.G.N.G. General Hospital during 2022-2024

Characteristics	Frequency (n)	Percentage (%)
Age group		
Group I (0-10 years)	4	7.5
Group II (11-20 years)	4	7.5
Group III (21-30 years)	12	22.6
Group IV (31-40 years)	12	22.6
Group V (41-50 years)	10	18.9
Group VI (51-60 years)	7	13.2
Group VII (>60 years)	4	7.5
Sex		
Male	28	52.8
Female	25	47.2
Comorbid condition		
Extrapulmonary TB with pulmonary TB	13	24.5
Extrapulmonary TB without pulmonary TB	40	75.5
Neurological status (ASIA Impairment Scale)		
A	0	0
B	3	5.7
C	2	3.8
D	15	28.3
E	33	62.3
Total	**53**	**100**

Radiological findings in patients with tuberculous spondylitis

Radiological findings are presented in Table 2. All patients (100%) demonstrated imaging features consistent with tuberculous spondylitis. The most frequently involved vertebral region was the lumbar spine in 21 patients (39.6%), followed by the thoracic region in 18 patients (33.9%) and the thoracolumbar region in 10 patients (18.9%). Lumbosacral involvement was observed in 4 patients (7.5%), while cervical and cervicothoracic involvement were each identified in 1 patient (1.9%). No cases were found in the craniocervical region or the sacrum-coccyx region. Skip lesions were recorded in 2 patients (3.8%), involving cervical-lumbar and thoracic-lumbar combinations. Regarding lesion morphology, the paradiscal pattern was the most common, occurring in 43 patients (81.1%). Central lesions were identified in 8 patients (15.1%), whereas anterior (subperiosteal) and posterior (appendiceal) lesions were each observed in 1 patient (1.9%). In terms of deformity patterns and/or the extent of vertebral involvement, gibbus deformity was present in 27 patients (50.9%), rounded kyphosis in 17 patients (32.1%), and knuckle deformity in 7 patients (13.2%).

Table 2. Radiological Findings of Patients with Tuberculous Spondylitis at Prof. Dr. I.G.N.G. General Hospital during 2022-2024

Characteristics	Frequency (n)	Percentage (%)
Imaging findings consistent with tuberculous spondylitis		
Positive	53	100
Negative	0	0
Affected vertebral level		
Craniocervical	0	0
Cervical	1	1.9
Cervicothoracic	1	1.9
Thoracic	18	33.9
Thoracolumbar	10	18.9
Lumbar	21	39.6
Lumbosacral	4	7.5

Sacrum (below S1) and coccyx	0	0
Lesion morphology		
Paradiscal	43	81.1
Central	8	15.1
Anterior (subperiosteal)	1	1.9
Posterior (appendiceal)	1	1.9
Extent of vertebral involvement		
Knuckle	7	13.2
Gibbus	27	50.9
Rounded Kyphosis	17	32.1
Skip Lesions	2	3.8
Total	**53**	**100**

Hematological laboratory results in patients with tuberculous spondylitis

The hematological laboratory results of patients with tuberculous spondylitis are summarized in Table 3. The leukocyte count was within the normal range (4,500-10,000 cells/µL) in 35 patients (66.0%). Leukocytosis (>10,000 cells/µL) was observed in 16 patients (30.2%), while leukopenia (<4,500 cells/µL) was found in 2 patients (3.8%). Erythrocyte sedimentation rate (ESR) was elevated in 51 patients (96.2%), whereas normal ESR was observed in 2 patients (3.8%). C-reactive protein (CRP) levels were increased in 39 patients (73.6%), while 14 patients (26.4%) had values within the normal range.

Table 3. Hematological Laboratory Results in Patients with Tuberculous Spondylitis at Prof. Dr. I.G.N.G. General Hospital during 2022-2024

Characteristics	Frequency (n)	Percentage (%)
Leukocyte count (cells/µL)		
<4,500	2	3.8
4,500-10,000	35	66
>10,000	16	30.2
Erythrocyte sedimentation rate (ESR)		
Normal (<10 mm/hour in males and <20 mm/hour in females)	2	3.8
Elevated	51	96.2
***C-Reactive Protein* (CRP)**		
Normal (<5 mg/L)	14	26.4
Elevated	39	73.6
Total	**53**	**100**

Management of Patients with Tuberculous Spondylitis

Operative management was performed in 34 patients (64.2%), while conservative management was applied in 19 patients (35.8%). Among patients who underwent surgery and biopsy, histopathology confirmed tuberculosis in 16 patients (47.1%). Non-specific histopathological findings (not typical of tuberculous spondylitis) were identified in 14 patients (41.2%). Histopathological examination was not performed in 4 patients (11.8%). Management data are presented in Table 4.

Table 4. Management Approaches and Histopathological Results in Patients with Tuberculous Spondylitis at Prof. Dr. I.G.N.G. General Hospital during 2022-2024

Characteristics	Frequency (n)	Percentage (%)
Management approach		
Conservative (treatment with anti-tuberculosis drugs (ATD) or the use of external support)	19	35.8
Operative	34	64.2
Total	**53**	**100**
Histopathological results based on biopsy		
Confirmed	16	47.1
Non-specific findings	14	41.2

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Not performed	4	11.8
Total	**34**	**100**

DISCUSSION

This study showed that patients with tuberculous spondylitis treated at Prof. Dr. I.G.N.G. Ngoerah General Hospital between 2022 and 2024 were predominantly from the productive age group of 21-40 years, with a mean age of 36.79 ± 16.08 years. This finding indicates that tuberculous spondylitis in this study population was more frequently observed in individuals of working age. This pattern may be related to higher mobility and social activity among working-age adults, which could increase the likelihood of exposure to *Mycobacterium tuberculosis*.[9–11] Several studies have also reported mean ages consistent with our findings, typically within the third to fourth decades of life.[12–14] However, a study in China reported a higher mean age.[15]This suggests regional variation in patient characteristics, which may be influenced by differences in local demographic distributions, referral patterns, and variation in comorbidities and risk factors across populations.[15]

Sex distribution in this study was relatively balanced, with a slightly higher proportion of males (52.8%) than females (47.2%). This finding is consistent with several studies reporting male predominance in tuberculous spondylitis, including reports from national referral centers in Indonesia.[12,15–17] In addition, the World Health Organization has consistently reported a higher burden of tuberculosis among males.[3] This has been associated with differences in exposure, health-related behaviors, and disparities in case detection between men and women. Nevertheless, some studies in Indonesia have reported a contrasting pattern with female predominance.[13,14] Such variation may reflect differences in referral population demographics, earlier health-seeking behavior among women, and regional differences in immunity and comorbidities.[13,14] Therefore, sex distribution in tuberculous spondylitis may vary across regions depending on local population characteristics and accompanying socio-biological factors.

In the present study, most patients with tuberculous spondylitis did not have active pulmonary tuberculosis (75.5%), while 24.5% were documented as having pulmonary TB. This proportion is comparable to findings from a study in China reporting pulmonary TB in 26.6% of tuberculous spondylitis cases.[15] Similar results have also been reported in Indonesia, where involvement of other organs, including the lungs, was noted in 48.7% of patients.[16] However, other studies have reported higher rates of pulmonary involvement among patients with tuberculous spondylitis.[18,19] These differences may be explained by the pathogenesis of tuberculous spondylitis, which is not always associated with active pulmonary disease, as tuberculous spondylitis can arise from reactivation of latent foci following primary bacteremia or from a new infection via hematogenous spread.[20–22] Thus, the presence of active pulmonary tuberculosis is variable, and its absence does not exclude a diagnosis of tuberculous spondylitis in patients with compatible clinical and radiological findings.

Neurological status in this study was predominantly ASIA Impairment Scale (AIS) grade E (62.3%), followed by AIS D (28.3%), while AIS B-C occurred in only a small proportion of cases and no patients had AIS A. These findings indicate that most patients presented without severe neurological deficits, although the overall proportion with neurological impairment remained clinically relevant (37.7%). This proportion was lower than that reported in a study conducted in China, which found neurological deficits in nearly half of cases, although AIS D remained the most common impaired category.[15] In contrast, studies conducted in two Indonesian hospital centers reported higher rates of neurological deficits in their referral populations.[13,16] Such variation may be influenced by the level and extent of vertebral involvement, the presence of paravertebral abscesses, and the degree of kyphosis, which determine the risk of spinal cord compression, particularly in the thoracic and thoracolumbar segments.[21] Diagnostic delay may also play an important role, as patients presenting earlier are more likely to be graded AIS D or E, whereas delayed presentation increases the risk of paraplegia.[23]

All patients in this study underwent MRI examination. Radiological findings in all cases were consistent with tuberculous spondylitis. The lumbar spine was the most commonly affected region (39.6%), followed by the thoracic (33.9%) and thoracolumbar regions (18.9%). This predilection pattern is consistent with several studies reporting lumbar and thoracic involvement as the most frequent locations.[12,15] Conversely, some local studies reported thoracic predominance.[16,17] This again suggests variation across referral populations, potentially influenced by demographic characteristics, referral patterns, and differences in disease severity. From a pathogenesis perspective, lumbar and thoracolumbar involvement aligns with the concept that the thoracolumbar junction bears high mechanical stress and has rich vascular supply via Batson's venous plexus, making it susceptible to tuberculous bacillary seeding.[21] Regarding lesion morphology, the paradiscal pattern was the most common (81.1%). This is consistent with the literature, which describes the the paradiscal form as the typical presentation of spinal TB, attributable to bacilli deposition in the subchondral vascular supply near the vertebral endplate, leading to paradiscal destruction and extension into the intervertebral disc.[21]

In this study, the most frequent spinal deformity pattern was gibbus (50.9%), followed by rounded kyphosis (32.1%) and knuckle deformity (13.2%), while skip lesions were observed in only 3.8% of cases. These findings are consistent with Indonesian studies that also identified gibbus

as the most common deformity complication in tuberculous spondylitis.[14,16] Pathogenetically, gibbus deformity results from multi-level anterior vertebral body collapse (commonly involving two vertebrae), producing a sharp kyphotic angulation, particularly in the thoracic and thoracolumbar regions.[21] Although uncommon, skip lesions are clinically important because they reflect noncontiguous multi-level involvement that may be missed if evaluation focuses on a single spinal segment. The low incidence of skip lesions is consistent with previous reports, and this phenomenon may occur through hematogenous dissemination via Batson's venous plexus, resulting in bacillary implantation at distant spinal levels.[12] Accordingly, these findings support the importance of whole-spine MRI in patients suspected of having tuberculous spondylitis.[23]

Hematological laboratory results showed that most patients had a normal leukocyte count (66.0%), whereas leukocytosis was observed in 30.2% and leukopenia in 3.8%. This pattern emphasizes that leukocyte count is not a consistent marker of tuberculous spondylitis, consistent with previous studies.[14] In contrast, ESR was elevated in 51 of 53 patients (96.2%) and CRP in 39 of 53 cases (73.6%), suggesting that these inflammatory markers may be more sensitive in supporting the suspicion of tuberculous spondylitis.[23,24] Elevated ESR and CRP reflect a systemic inflammatory response in chronic granulomatous infection, although they remain nonspecific and should be interpreted alongside clinical and imaging findings. Nevertheless, the literature indicates that a small proportion of patients may have normal ESR/CRP values.[25] Therefore, inflammatory markers cannot be used as the sole basis for diagnosis.

Most patients in this study underwent operative management (64.2%), while 35.8% were managed conservatively. The predominance of surgical intervention is consistent with management guidelines recommending surgery for cases with neurological deficits, severe deformity, spinal instability, persistent pain, or diagnostic uncertainty requiring biopsy.[8,26] Among operatively managed patients who underwent biopsy, histopathology confirmed tuberculosis in 47.1% of cases, while 41.2% showed nonspecific findings. This relatively modest confirmation rate may be explained by the paucibacillary nature of TB lesions, in which granulomas or caseous necrosis may not be identified in the sampled tissue.[27] Therefore, nonspecific histopathological findings do not necessarily exclude tuberculous spondylitis, and diagnosis should be established by integrating clinical, radiological, microbiological, and histopathological findings.

Despite the predominance of operative management, approximately one-third of patients in this study could still be managed conservatively. This underscores the important role of conservative therapy, particularly in patients without spinal instability or severe neurological deficits. The literature supports the use of prolonged anti-tuberculosis therapy combined with immobilization to achieve favorable outcomes in cases with minimal deformity, small abscesses, and stable neurological status.[20] In addition, the "middle-path regimen" emphasizes that surgery should be selective and reserved for specific indications, while the majority of cases can be managed optimally with conservative management.[22] Thus, our findings support the importance of appropriately selecting surgical indications and strengthening conservative management as a key pillar of treatment.

This study has several limitations. First, the sample size was limited and derived from a single national referral center; therefore, generalization to broader populations should be made with caution. Second, the use of secondary data from medical records depended on the completeness and consistency of documentation, which may introduce information bias. Third, this descriptive study did not include bivariate or multivariable analyses; thus, associations between variables and the influence of potential confounders could not be evaluated. Finally, the cross-sectional design captures findings at a single point in time and does not allow assessment of temporal relationships or causality.

CONCLUSION

Based on the findings of this study, tuberculous spondylitis cases at Prof. Dr. I.G.N.G. Ngoerah General Hospital were predominantly observed in the productive age group, with a relatively balanced sex distribution. Most patients did not have active pulmonary tuberculosis, and the majority presented with normal neurological status (AIS grade E), although neurological deficits were still observed in a subset of cases. Radiological findings in all patients were consistent with tuberculous spondylitis, with a predilection for the lumbar and thoracic regions and a predominance of the paradiscal lesion pattern. From a laboratory perspective, ESR and CRP were elevated in most patients, whereas leukocyte counts were generally within the normal range. Operative management was more frequently performed than conservative management, and histopathological confirmation of tuberculosis was obtained in fewer than half of the patients who underwent biopsy.

Prospective multicenter studies involving both referral and non-referral hospitals are needed to generate more representative and generalizable evidence, and to enable analysis of risk factors (e.g., comorbidities and clinical symptoms) in relation to clinical outcomes such as VAS, SF-36, neurological status, deformity progression, and the need for surgery.

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